

REMARKS

Examiner Nadav is thanked for his thorough examination of the Subject Patent Application. Amendments have been made to the Claims, and in so doing are now believed to render the Claims distinguishable from Examiners cited prior art and therefore be in condition for allowance.

The correction of original drawing for Fig. 7B, submitted 01/14/03, is withdrawn, (as Examiner suggested).

Referring to the rejection of Claims 20 - 24, based on 35 USC 112, regarding lack of support for the term "space" in independent Claim 20, the erroneous term "space" has been replaced in amended Claim 20, by the term "discontinuous". Discontinuous referring to the difference in thickness between metal spacer 8c, (located on the sides of via hole 6b, and overlying a portion of metal plug structure 7b), and of metal spacers 8c, located in the center of via hole 6b, with the thinness of metal spacers 8c, located in the center of via hole 6b, now resulting in a discontinuity with the thicker metal spacer portions. In addition the unclear description in Claim 20, regarding "adjacent to only one side of the via hole" has been removed. Therefore reconsideration of the rejection of Claims 20 - 24, based on 35 USC 112, is requested as a result of the amendments made to the independent Claim 20.

Referring to the rejection of Claims 20 and 24, under 35 USC 102, as being anticipated by Harada et al (US 5,341,026), independent Claim 20, has been amended to more clearly describe

applicants structure and in so doing become clearly distinguishable from the Harada et al prior art. The metal ring structure in amended independent Claim 20, intentionally terminates at the center of the top surface of via hole opening 6b, rendering the metal ring structure discontinuous at the bottom of the via hole. The Harada et al prior art does not show the discontinuous metal spacers described by applicant, only describing a continuous metal structure 100, in a via hole opening. Applicant intentionally fashions the discontinuity resulting in the drawings shown in Figs. 7A and 7B, while Harada et al, only show a standard metal structure in a via hole, without a “hint” of possible discontinuity. Therefore reconsideration of independent Claim 20, and referencing dependent Claims 21 - 24, rejected based on 35 USC 102, is requested based on the amendments made as well as based on the arguments presented.

Regarding the rejection of Claims 20 - 24, under 35 USC 103, the amendments made to the Claims, and the arguments presented in response to the 35 USC 102 rejection, are again used. None of Examiners prior art (Harada et al, US 5,341,026), describe the unique features of applicants structure, such as discontinuous metal spacers terminating in the center of the top surface of the recessed metal plug structure. The rejected dependent Claims 21 - 24, now refer to amended independent Claim 20. Therefore since none of Examiner’s cited prior art describe the unique structural features listed in applicants amended structural invention, neither will any combination of prior art offer applicants structure. Applicant has claimed his process in detail. The structure shown in Figs. 1 - 6, 7A and 7B, and described in amended Claims 20- 24, are both believed to be novel and patentable over Examiner’s cited art references, because there is no

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evidence that these prior arts described a planar metal structure attached to a metal ring structure, wherein the metal ring structure in turn is comprised with metal spacers, featuring a discontinuity of metal spacers as they converge in the center of the via hole. We therefore request Examiner Nadav to reconsider his rejection of Claims 20 - 24, under 35 USC 103, in view of these arguments and the amendments to the Claims.

Allowance of all Claims is requested.

Attached hereto is a marked-up version of the changes made to the Claims by the current amendment.

"Version with markings to show changes made"

It is requested that should Examiner Nadav not find that the Claims are now Allowable that he call the undersigned attorney at 845-452-5863, to overcome any problems preventing allowance.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

PLEASE AMEND THE CLAIMS AS FOLLOWS:

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Claim 20. (currently amended) A metal structure on a semiconductor substrate, comprising:

a via hole in an insulator layer exposing a portion of an underlying lower level metal interconnect structure

5 a recessed metal plug structure located in a bottom portion of said via hole, with said recessed metal plug structure overlying and contacting the portion of said lower level metal interconnect structure exposed in said via hole; and

10 said metal structure comprised with a first portion located on a smooth top surface of said insulator layer situated only adjacent to one side of said via hole, and with said metal structure comprised with a second portion attached to said first portion of said metal structure, wherein said second portion is a metal ring structure comprised of metal spacers located on the sides of a top portion of said via hole and located overlying only first portions of a top surface of said recessed metal plug structure located at the bottom of said via hole, resulting in a space discontinuity between said metal spacers at bottom of said via hole, wherein the thickness of said metal ring structure on sides of top
15 portion of said via hole is greater than the thickness of said metal ring structure located on center portion of said metal plug structure. ~~exposing a second portion of said top surface of said recessed metal plug structure.~~

Claim 21. (previously amended) The metal structure of claim 20, wherein said lower level metal interconnect structure is comprised of a composite metal structure, featuring an aluminum, or an aluminum based layer, at a thickness between about 2000 to 20000 Angstroms, with an underlying titanium nitride layer, at a thickness between about 100 to 1500 Angstroms, and an overlying titanium nitride layer, at a thickness between about 100 to 1500 Angstroms.

E1 Claim 22. (previously amended) The metal structure of claim 20, wherein said via hole is comprised with a diameter between about 0.10 to 1.0 μm .

Claim 23. (previously amended) The metal structure of claim 20, wherein said recessed metal plug structure, is comprised of tungsten, with the height of said recessed metal plug structure, located in said bottom portion of said via hole, between about 3000 to 20000 Angstroms.

Claim 24. (previously amended) The metal structure of claim 20, wherein said metal ring structure, attached to said first portion of said metal structure, is comprised of aluminum, or aluminum - copper spacers, located on the sides of said top portion of said via hole.